PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PD020082	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/EP 03/50362	International filing date *(day/month/year)* 05.08.2003	Priority date *(day/month/year)* 23.08.2002
International Patent Classification (IPC) or both national classification and IPC G09G3/28		
Applicant THOMSON LICENSING SA et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the International application

Date of submission of the demand	Date of completion of this report
08.03.2004	08.10.2004
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Fulcheri, A Telephone No. +49 89 2399-7050

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP 03/50362

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-11	as originally filed

Claims, Numbers

13-16	as originally filed
1-12	received on 02.08.2004 with letter of 02.08.2004

Drawings, Sheets

1/6-6/6	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

   ☐ the entire international application,

   ☒ claims Nos. 4-7,11-12

   because:

   ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

   ☒ the description, claims or drawings *(indicate particular elements below)* or said claims Nos. 4-7,11-12 are so unclear that no meaningful opinion could be formed *(specify)*:

   see separate sheet

   ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

   ☐ no international search report has been established for the said claims Nos.

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

   ☐ the written form has not been furnished or does not comply with the Standard.

   ☐ the computer readable form has not been furnished or does not comply with the Standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	1-3,8-10
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-3,8-10
Industrial applicability (IA)	Yes:	Claims	1-3,8-10
	No:	Claims	

2. Citations and explanations

see separate sheet

1. Reference is made to the following documents:

   D1: EP0948195
   D2: EP0866618
   D3: W0 02/42834

   Document D3 was not cited in the International Search Report. A copy of this document is appended to this communication.

2. Claims 1-12 are not supported by the description as required by Article 6 PCT, as their scope is broader than justified by the description and drawings. The reasons therefor are the following.

   Since the definition "digital display device" is vague; one would understand that a LC display having a digital input could be defined as digital display device, thus falling into the scope of the current claims , but the perceived problem (as defined in the description form page 1, line 11 to page 4, line 11) would, in this case, not arise and the proposed solution would not be applicable.

   The perceived problem, as defined in the application, relates to the reduction of quantisation noise in PWM-driven plasma display panels. The examiner acknowledges that the method appears applicable to binary display devices, that is devices (like plasma or DMD displays, etc) in which the pixel cells are digitally driven and they can only have two states: ON or OFF (see for example D3, page 1 , line 18 to page 2, line 8).
   This differentiates said displays, for example, from LC displays where the pixel cells are able to assume more than two states depending on the applied voltage.

   Finally, the examiner notes that since throughout the description the wording "binary display" is not used, it seems opportune in the claims to substitute the wording "digital display device" with "display device with digitally driven pixels".

   In this case the above mentioned objection would appear to be overcome.

Re Item III

3. The application does not meet the requirements of Article 6 PCT, because claims 4-7, 11 and 12 are not clear.

3.1 The wording of claim 4 and 11 is unclear because of the wording "the value of a filter coefficient decreases when the luminance of the current pixels increases".
Since no details of the coefficients of the filter are given, it is unclear how the variation of a coefficient is linked to the solution of the problem, that is to have a filter which has a stronger effect on low brightness regions of the display while having very little or no effect on luminous regions.

3.2 The wording of claims 5 and 12 is obscure because it seems to suggest that the hardware structure of the filter can vary depending on the video level of a pixel but does not specifies how this is actually done and how the variation of the video level is linked to said structure. Moreover the wording "temporal direction" does not properly limit the extent of the subject matter for which protection is sought.

3.3 Claim 6 is unclear because the function *fi* is not defined.

3.4 Claim 7 is unclear because the values X0, X2n are not defined and the wording "a limit of neighbor" does not have a clear meaning.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

4. Notwithstanding the objection raised in sections 2 to 3.4 above, the present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1-3, 8-10 is not new in the sense of Article 33(2) PCT.

4.1 Document D1 discloses (the references in parentheses applying to this document) a method and an apparatus for reducing noise caused by quantisation during the signal processing of a digital display device (paragraphs 1 and 2) wherein the video signal is filtered with a adaptive filter having a plurality of coefficients, said coefficients being varied in dependence of a value of the video level of the pixels (paragraphs 5, 6, 11 and 12, Fig. 5).

It is noted that the expression "matrix of video level" of present claim 1 appears to merely define a "mathematical" representation of the video signal corresponding to the pixels in the video image.
D1 specifies that an input video digital signal is provided to a filter apparatus and that each pixel of the video signal is analysed and compared with adjacent pixels (see paragraph 5), therefore including a "description" of the levels of the video pixel representing the whole screen. This can obviously be regarded as a matrix representation of the data representing the video signal displayed on the display device.

Moreover, as defined in paragraph 12, the calculation of the filter coefficients depends of the pixel content (that is, the pixel video levels).

D1 discloses all the features of present claims 1 and 8, the claims are therefore not new in the sense of Article 33(2) PCT.

4.2 For the sake of completeness, it is noted that document D2 discloses (the references in parentheses applying to this document) a method and an apparatus for reducing noise caused by quantisation during the signal processing of a digital display device (column 1, lines 12-17 and 45-52) wherein the video signal is filtered with a adaptive filter (column 10, line 54 to column 11, line 9) having a plurality of coefficients, said coefficients being varied in dependence of a value of the video level of the pixels (column 11, line 10 to column 12, line 39; column 13, lines 26-41; Fig. 2 and 11), as defined in claims 1-3 and 10-12

4.3 Document D2 also discloses that the filtering process includes low pass filtering (column 11, lines 53-55) and median filtering (Fig. 11, item 1116), as defined present claims 2, 3, 9 and 10.

REPLACED BY ART 34 AMDT

Claims

1. Method for reducing noise caused by a quantization procedure during the signal processing of a digital display device by
digitally filtering a signal charged with said noise with a digital filter having a plurality of filter coefficients,
characterized by
varying at least one of said filter coefficients in dependence on a value of said signal to be filtered.

2. Method according to claim 1, wherein said signal includes a matrix of video levels of pixels of said display device.

3. Method according to claim 1 or 2, wherein said value of said signal includes a video level of a current pixel.

4. Method according to one of the claims 1 to 3, wherein said filtering includes one and/or two dimensional low pass filtering.

5. Method according to one of the claims 1 to 4, wherein said filtering includes one and/or two dimensional median filtering.

6. Method according to one of the claims 1 to 5, wherein the value of a filter coefficient decreases with a luminance of a current pixel.

7. Method according to one of the claims 1 to 6, wherein the structure of said digital filter varies with the video level of a current pixel.

8. Method according to one of claims 1 to 7, wherein, in case of a low pass filter, the coefficients are given by $\frac{1}{\sum_{i=0}^{i=8} a_i}\begin{vmatrix} a_2 & a_3 & a_4 \\ a_1 & a_0 & a_5 \\ a_8 & a_7 & a_6 \end{vmatrix}$

with $a_0=1$ and with $a_i=f_i(x_0, x_i)$.

9. Method according to claim 8, wherein, the function is the following:

$$f_{2n}(x_o, x_{2n}) = \begin{cases} \alpha \text{ if } |x_{2n} - x_0| \le \Delta \\ 0 \end{cases} \quad \text{and} \quad f_{2n+1}(x_o, x_{2n+1}) = \begin{cases} \beta \text{ if } |x_{2n+1} - x_0| \le \Delta \\ 0 \end{cases}$$

with Δ a limit of neighbor.

10. Device for reducing noise caused by a quantisation during the signal processing of a digital display device including
digital filter means for digitally filtering a signal charged with said noise, said filter means having a plurality of filter coefficients,
characterized by
controlling means connected to said digital filter means for varying at least one of said filter coefficients in dependence on a value of said signal to be filtered.

11. Device according to claim 10, wherein said signal includes a matrix of video levels of pixels of said display device.

12. Device according to claim 10 or 11, wherein said value of said signal includes a video level of a current pixel.

13. Device according to one of the claims 10 to 12, wherein said digital filter means includes one and/or two dimensional low pass filter.

14. Device according to one of the claims 10 to 13, wherein said digital filter means includes a one and/or two dimensional median filter.

15. Device according to one of the claims 10 to 14, wherein the value of a filter coefficient is decreasable with the luminance of a current pixel by said controlling means.

16. Device according to one of the claims 10 to 15, wherein the structure of a filter of said digital filter means is variable with the video level of a current pixel by said controlling means.